DEPARTMENT OF THE AIR FORCE
59TH MEDICAL WING (AETC)
JOINT BASE SAN ANTONIO - LACKLAND TEXAS

9 MAY 2017

MEMORANDUM FOR SGVT
ATTN: CAPT DONOVAN REED

FROM: 59 MDW/SGVU

SUBJECT: Professional Presentation Approval

1. Your paper, entitled **Retrospective Analysis of the Post-Operative Changes in Higher Order Aberrations: A Comparison of the EX500 to the Allegretto and VISX S4 Laser in Refractive Surgery** presented at/published to **Journal of Military Medicine and San Antonio Military Health Systems and Universities Research Forum, 16 June 17** in accordance with MDWI 41-108, has been approved and assigned local file #**17229.**

2. Pertinent biographic information (name of author(s) title, etc.) has been entered into our computer file. Please advise us (by phone or mail) that your presentation was given. At that time, we will need the date (month, day and year) along with the location of your presentation. It is important to update this information so that we can provide quality support for you, your department, and the Medical Center commander. This information is used to document the scholarly activities of our professional staff and students, which is an essential component of Wilford Hall Ambulatory Surgical Center (WHASC) internship and residency programs.

3. Please know that if you are a Graduate Health Sciences Education student and your department has told you they cannot fund your publication, the 59th Clinical Research Division may pay for your basic journal publishing charges (to include costs for tables and black and white photos). We cannot pay for reprints. If you are a 59 MDW staff member, we can forward your request for funds to the designated Wing POC at the Chief Scientist's Office, Ms. Alice Houy, office phone: 210-292-8029; email address: alice.houy.civ@mail.mil.

4. Congratulations, and thank you for your efforts and time. Your contributions are vital to the medical mission. We look forward to assisting you in your future publication/presentation efforts.

for Jane Bennett

LINDA STEEL-GOODWIN, Col, USAF, BSC
Director, Clinical Investigations & Research Support

PROCESSING OF PROFESSIONAL MEDICAL RESEARCH/TECHNICAL PUBLICATIONS/PRESENTATIONS

INSTRUCTIONS

USE ONLY THE MOST CURRENT 59 MDW FORM 3039 LOCATED ON AF E-PUBLISHING

1. The author must complete page two of this form:
   a. In Section 2, add the funding source for your study [e.g., 59 MDW CRD Graduate Health Sciences Education (GHSE) (SG5 O&M), SG5 R&D, Tri-Service Nursing Research Program (TSNRP), Defense Medical Research & Development Program (DMRDP), NIH, Congressionally Directed Medical Research Program (CDMRP) ; Grants, etc.]

   b. In Section 2, there may be funding available for journal costs, if your department is not paying for figures, tables or photographs for your publication. Please state "YES" or "NO" in Section 2 of the form, if you need publication funding support.

2. Print your name, rank/grade, sign and date the form in the author's signature block or use an electronic signature.

3. Attach a copy of the 59 MDW IRB or IACUC approval letter for the research related study. If this is a technical publication/presentation, state the type (e.g. case report, QA/QI study, program evaluation study, informational report/briefing, etc.) in the "Protocol Title" box.

4. Attach a copy of your abstract, paper, poster and other supporting documentation.

5. Save and forward, via email, the processing form and all supporting documentation to your unit commander, program director or immediate supervisor for review/approval.

6. On page 2, have either your unit commander, program director or immediate supervisor:
   a. Print their name, rank/grade, title, sign and date the form in the approving authority's signature block or use an electronic signature.

7. Submit your completed form and all supporting documentation to the CRD for processing (59crdpubspres@us.af.mil). **This should be accomplished no later than 30 days before final clearance is required to publish/present your materials.** If you have any questions or concerns, please contact the 59 CRD/Publications and Presentations Section at 292-7141 for assistance.

8. The 59 CRD/Publications and Presentations Section will route the request form to clinical investigations, 502 ISG/JAC (Ethics Review) and Public Affairs (59 MDW/PA) for review and then forward you a final letter of approval or disapproval.

9. Once your manuscript, poster or presentation has been approved for a one-time public release, you may proceed with your publication or presentation submission activities, as stated on this form. **Note:** For each new release of medical research or technical information as a publication/presentation, a new 59 MDW Form 3039 must be submitted for review and approval.

10. If your manuscript is accepted for scientific publication, please contact the 59 CRD/Publications and Presentations Section at 292-7141. This information is reported to the 59 MDW/CC. All medical research or technical information publications/presentations must be reported to the Defense Technical Information Center (DITC). See 59 MDWI 41-108, *Presentation and Publication of Medical and Technical Papers*, for additional information.

11. The Joint Ethics Regulation (JER) DoD 5500.07-R, *Standards of Conduct*, provides standards of ethical conduct for all DoD personnel and their interactions with other non-DoD entities, organizations, societies, conferences, etc. Part of the Form 3039 review and approval process includes a legal ethics review to address any potential conflicts related to DoD personnel participating in non-DoD sponsored conferences, professional meetings, publication/presentation disclosures to domestic and foreign audiences, DoD personnel accepting non-DoD contributions, awards, honoraria, gifts, etc. The specific circumstances for your presentation will determine whether a legal review is necessary. **If you (as the author) or your supervisor check "NO" in block 17 of the Form 3039, your research or technical documents will not be forwarded to the 502 ISG/JAC legal office for an ethics review.** To assist you in making this decision about whether to request a legal review, the following examples are provided as a guideline:

    For presentations before professional societies and like organizations, the 59 MDW Public Affairs Office (PAO) will provide the needed review to ensure proper disclaimers are included and the subject matter of the presentation does not create any cause for DoD concern.

    If the sponsor of a conference or meeting is a DoD entity, an ethics review of your presentation is not required, since the DoD entity is responsible to obtain all approvals for the event.

    If the sponsor of a conference or meeting is a non-DoD commercial entity or an entity seeking to do business with the government, then your presentation should have an ethics review.

    If your travel is being paid for (in whole or in part) by a non-Federal entity (someone other than the government), a legal ethics review is needed. These requests for legal review should come through the 59 MDW Gifts and Grants Office to 502 ISG/JAC.

    If you are receiving an honorarium or payment for speaking, a legal ethics review is required.

    If you (as the author) or your supervisor check "YES" in block 17 of the Form 3039, your research or technical documents will be forwarded simultaneously to the 502 ISG/JAC legal office and PAO for review to help reduce turn-around time. If you have any questions regarding legal reviews, please contact the legal office at (210) 671-5795/3365, DSN 473.

NOTE: All abstracts, papers, posters, etc., should contain the following disclaimer statement:
"The views expressed are those of the [author(s)] [presenter(s)] and do not reflect the official views or policy of the Department of Defense or its Components"

NOTE: All abstracts, papers, posters, etc., should contain the following disclaimer statement for research involving humans:
"The voluntary, fully informed consent of the subjects used in this research was obtained as required by 32 CFR 219 and DODI 3216.02_AFI 40-402."

NOTE: All abstracts, papers, posters, etc., should contain the following disclaimer statement for research involving animals, as required by AFMAN 40-401_IP :
"The experiments reported herein were conducted according to the principles set forth in the National Institute of Health Publication No. 80-23, Guide for the Care and Use of Laboratory Animals and the Animal Welfare Act of 1966, as amended."

PROCESSING OF PROFESSIONAL MEDICAL RESEARCH/TECHNICAL PUBLICATIONS/PRESENTATIONS

1. TO: CLINICAL RESEARCH	2. FROM: (Author's Name, Rank, Grade, Office Symbol)	3. GME/GHSE STUDENT	4. PROTOCOL NUMBER
	Donovan Reed, Capt, O-3, 959 CSPS	☒ YES ☐ NO	20150099H

5. PROTOCOL TITLE (NOTE: For each new release of medical research or technical information as a publication/presentation, a new 59 MDW Form 3039 must be submitted for review and approval.)

Retrospective analysis of the post-operative changes in higher order aberrations: A comparison of the Ex500 to the Allegretto and Visx lasers

6. TITLE OF MATERIAL TO BE PUBLISHED OR PRESENTED

Retrospective analysis of the post-operative changes in higher order aberrations: A comparison of the Ex500 to the Allegretto and Visx lasers

7. FUNDING RECEIVED FOR THIS STUDY? ☐ YES ☒ NO FUNDING SOURCE:

8. DO YOU NEED FUNDING SUPPORT FOR PUBLICATION PURPOSES: ☐ YES ☒ NO

9. IS THIS MATERIAL CLASSIFIED? ☐ YES ☒ NO

10. IS THIS MATERIAL SUBJECT TO ANY LEGAL RESTRICTIONS FOR PUBLICATION OR PRESENTATION THROUGH A COLLABORATIVE RESEARCH AND DEVELOPMENT AGREEMENT (CRADA), MATERIAL TRANSFER AGREEMENT (MTA), INTELLECTUAL PROPERTY RIGHTS AGREEMENT ETC.?
☐ YES ☒ NO **NOTE:** If the answer is YES then attach a copy of the Agreement to the Publications/Presentations Request Form

11. MATERIAL IS FOR: ☒ DOMESTIC RELEASE ☐ FOREIGN RELEASE
CHECK APPROPRIATE BOX OR BOXES FOR APPROVAL WITH THIS REQUEST. ATTACH COPY OF MATERIAL TO BE PUBLISHED/PRESENTED

☒ 11a. PUBLICATION/JOURNAL (List intended publication/journal.)
Military Medicine

☐ 11b. PUBLISHED ABSTRACT (List intended journal.)

☒ 11c. POSTER (To be demonstrated at meeting; name of meeting, city, state, and date of meeting.)
San Antonio Military Health Systems and Universities Research Forum; 16 Jun 17

☒ 11d. PLATFORM PRESENTATION (At civilian institutions: name of meeting, state, and date of meting.)
San Antonio Military Health Systems and Universities Research Forum; 16 Jun 17

☐ 11e. OTHER (Describe: name of meeting, city, state, and date of meeting.)

12. HAVE YOUR ATTACHED RESEARCH/TECHNICAL MATERIALS BEEN PREVIOUSLY APPROVED TO BE PUBLISHED/PRESENTED?
☐ YES ☒ NO ASSIGNED FILE #: _____ DATE: _____

13. EXPECTED DATE WHEN YOU WILL NEED THE CRD TO SUBMIT YOUR CLEARED PRESENTATION/PUBLICATION TO DTIC
NOTE: All publications/presentations are required to be placed in the Defense Technical Information Center (DTIC).

DATE
1 June 2017

14. 59 MDW PRIMARY POINT OF CONTACT (Last Name, First Name, M.I., email)	15. DUTY PHONE/PAGER NUMBER
Apsey, Doug. A., douglas.apsey.2.ctr@us.af.mil	210-292-2554

16. AUTHORSHIP AND CO-AUTHOR(S): List in the order they will appear in the manuscript.

LAST NAME, FIRST NAME AND M.I.	GRADE/RANK	SQUADRON/GROUP/OFFICE SYMBOL	INSTITUTION (If not 59 MDW)
a. Primary/Corresponding Author Reed, Donovan S.	O-3/Capt	CSPS 959	
b. Apsey, Douglas A.	O-6/Col (Ret)	59 TRS	
c. Steigleman, Walter A.	O-5/CDR	59 TRS	
d. Townley, James R.	O-5/Lt Col	59 TRS	
e. Caldwell, Michael C.	O-5/Lt Col	59 TRS	

17. IS A 502 ISG/JAC ETHICS REVIEW REQUIRED (JER DOD 5500.07-R)? ☐ YES ☒ NO

I CERTIFY ANY HUMAN OR ANIMAL RESEARCH RELATED STUDIES WERE APPROVED AND PERFORMED IN STRICT ACCORDANCE WITH 32 CFR 219, AFMAN 40-401_IP, AND 59 MDWI 41-108. I HAVE READ THE FINAL VERSION OF THE ATTACHED MATERIAL AND CERTIFY THAT IT IS AN ACCURATE MANUSCRIPT FOR PUBLICATION AND/OR PRESENTATION.

18. AUTHOR'S PRINTED NAME, RANK, GRADE	19. AUTHOR'S SIGNATURE	20. DATE
Donovan Reed,Capt,O-3		04 Apr 2017
21. APPROVING AUTHORITY'S PRINTED NAME, RANK, TITLE	**22. APPROVING AUTHORITY'S SIGNATURE**	**23. DATE**
Brett Davies, Maj, APD		11 Apr 2017

PROCESSING OF PROFESSIONAL MEDICAL RESEARCH/TECHNICAL PUBLICATIONS/PRESENTATIONS

1st ENDORSEMENT (59 MDW/SGVU Use Only)

TO: Clinical Research Division 59 MDW/CRD Contact 292-7141 for email instructions.	24. DATE RECEIVED 8 May 2017	25. ASSIGNED PROCESSING REQUEST FILE NUMBER 17229
26. DATE REVIEWED 8 May 2017		27. DATE FORWARDED TO 502 ISG/JAC

28. AUTHOR CONTACTED FOR RECOMMENDED OR NECESSARY CHANGES: [X] NO [ ] YES If yes, give date: _____ [ ] N/A

29. COMMENTS [X] APPROVED [ ] DISAPPROVED

The poster presentation, article and oral presentation are approved.

30. PRINTED NAME, RANK/GRADE, TITLE OF REVIEWER	31. REVIEWER SIGNATURE	32. DATE
Rocky Calcote, PhD, Clinical Research Administrator	CALCOTE.ROCKY.D.1178245844	

2nd ENDORSEMENT (502 ISG/JAC Use Only)

33. DATE RECEIVED	34. DATE FORWARDED TO 59 MDW/PA

35. COMMENTS [ ] APPROVED (In compliance with security and policy review directives.) [ ] DISAPPROVED

36. PRINTED NAME, RANK/GRADE, TITLE OF REVIEWER	37. REVIEWER SIGNATURE	38. DATE

3rd ENDORSEMENT (59 MDW/PA Use Only)

39. DATE RECEIVED	40. DATE FORWARDED TO 59 MDW/SGVU
May 8, 2017	May 8, 2017

41. COMMENTS [X] APPROVED (In compliance with security and policy review directives.) [ ] DISAPPROVED

Please include this Disclaimer:
"The opinions expressed on this document are solely those of the author(s) and do not represent an endorsement by or the views of the United States Air Force, the Department of Defense, or the United States Government."

Once added, presentations are approved and cleared for public release

42. PRINTED NAME, RANK/GRADE, TITLE OF REVIEWER	43. REVIEWER SIGNATURE	44. DATE
Kevin Iinuma, SSgt/E-5, 59 MDW Public Affairs		May 8, 2017

4th ENDORSEMENT (59 MDW/SGVU Use Only)

45. DATE RECEIVED	46. SENIOR AUTHOR NOTIFIED BY PHONE OF APPROVAL OR DISAPPROVAL [ ] YES [ ] NO [ ] COULD NOT BE REACHED [ ] LEFT MESSAGE

47. COMMENTS [ ] APPROVED [ ] DISAPPROVED

48. PRINTED NAME, RANK/GRADE, TITLE OF REVIEWER	49. REVIEWER SIGNATURE	50. DATE

Retrospective analysis of the post-operative changes in higher order aberrations: A comparison of the WaveLight® EX500 to the VISX® S4 laser in refractive surgery

Donovan Reed MD, Doug Apsey OD,
Walter Steigleman MD, Matthew Caldwell MD,
J. Richard Townley MD

Wilford Hall Ambulatory Surgical Center (WHASC)

Disclaimer

- The view(s) expressed herein are those of the author(s) and do not reflect the official policy or position of Brooke Army Medical Center, the U.S. Army Medical Department, the U.S. Army Office of the Surgeon General, the Department of the Air Force, the Department of the Army or the Department of Defense or the U.S. Government

Introduction

- PRK & LASIK reduce spherical and cylindrical defocus
  - Aberrations of the cornea are insufficient to characterize the entire visual quality of an eye.
- Measurement of the entirety of ocular aberrations is the most definitive means to establish the true effect of refractive surgery on image quality and visual performance.[1]

- PRK and LASIK increase wavefront aberrations and alter the comparative contributions of coma- and spherical-like higher order aberrations often inherent to the natural eye.[2]
- RMS wavefront error as a metric of global image quality[3]
- Moshirfar et al. demonstrated both the VISX® CustomVue and WaveLight® Allegretto systems perform equally in terms of visual acuity, safety, and predictability in both PRK and LASIK[4,5]
  - Higher-order and spherical aberrations during photorefractive keratectomy, not statistically significant[4]

Purpose

- Future advancements in refractive surgery
- Investigate the utility of the current excimer lasers employed by the DoD in terms of induced aberrations to maximize refractive treatment.
- The impact on post-operative higher order aberrations between the currently available DoD laser platforms
  - Offer insight as to which provides the best overall image quality following refractive surgery in the active duty and DoD beneficiary population

Methods

- Retrospective analysis
- Pre and post-operative changes in higher order aberrations following refractive surgery with the WaveLight® EX500 Excimer Laser System (Alcon, Fort Worth, TX) and the VISX® Star S4 IR Excimer Laser System (Abbott Medical Optics, Santa Ana, CA)
- RMS
  - Pentacam

Inclusion Criteria

- Active duty military or DoD beneficiaries who had refractive surgery at the Joint Warfighter Refractive Surgery Center and:
  - were 21 years of age or older
  - had PRK or LASIK refractive surgery
  - completed a 3 month follow-up visit

Exclusion Criteria

- Subjects who do not meet the inclusion criteria listed
- Subjects who previously had refractive surgery
- Patients who did not have follow-up data
- Pregnant women or incompetent adults

Methods

- Matching
- SPSS statistics
  - Student's T-test
  - Regression analysis: preoperative SE
    - Larger refractive errors = larger ablations

Results

	PRK	LASIK
VISX		
Age at Surgery (Mean)	29.4	31.5
Gender (Total)	74M 26F	16M 6F
PreOp MSE	-3.33	-2.73
Total Eyes	100	22
EX500		
Age at Surgery (Mean)	29.1	30.2
Gender	56M 40F	16M 6F
PreOp MSE	-3.35	-4.38
Total Eyes	96	22

Table 1: Patient Demographics

Results

	Mean Δ RMS	SD	p-Value (T-test)
PRK			0.431
VISX©	0.00122	0.02583	
EX500	0.004323	0.02916	
LASIK			0.295
VISX	0.00841	0.03011	
EX500	0.0174	0.02417	

Table 2: Change in RMS statistics

Results

	PRK		LASIK	
	b	p	b	p
PreOp MSE	-0.001	0.551	-0.003	0.161
Laser (EX500 w VISX)	0.003	0.433	0.004	0.670

Table 3: Regression Analysis concerning pre-operative refractive error for both LASIK and PRK

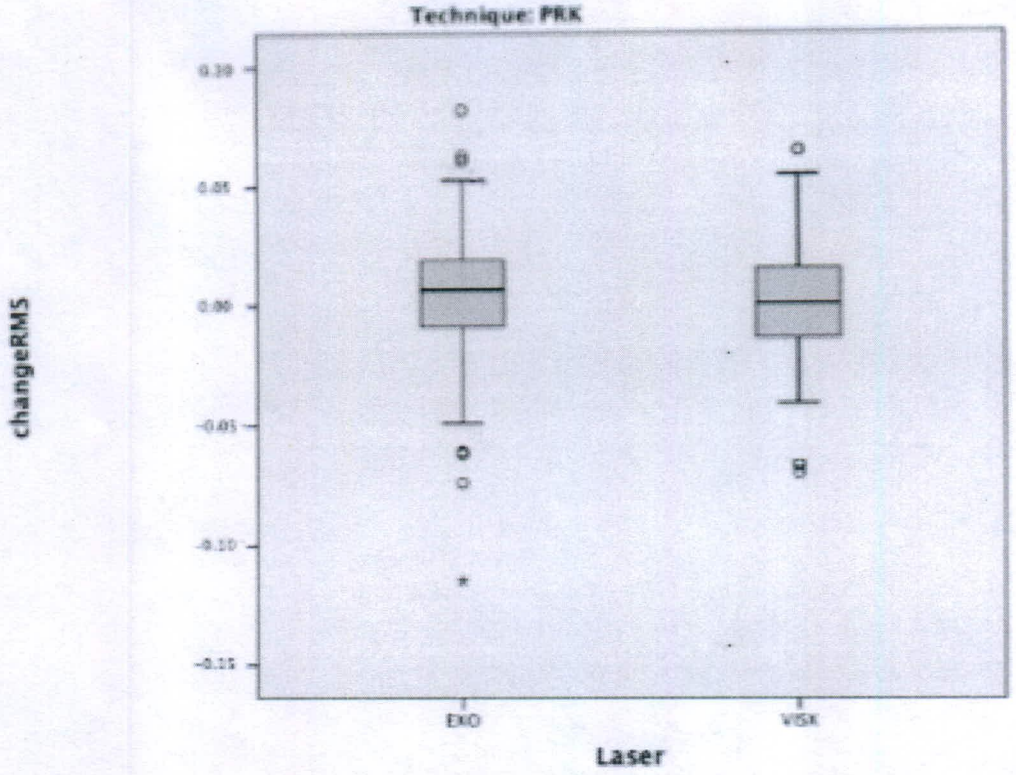

Figure 1: Change in RMS data for PRK between the VISX© and WaveLight© EX500 Lasers. p-value is 0.431

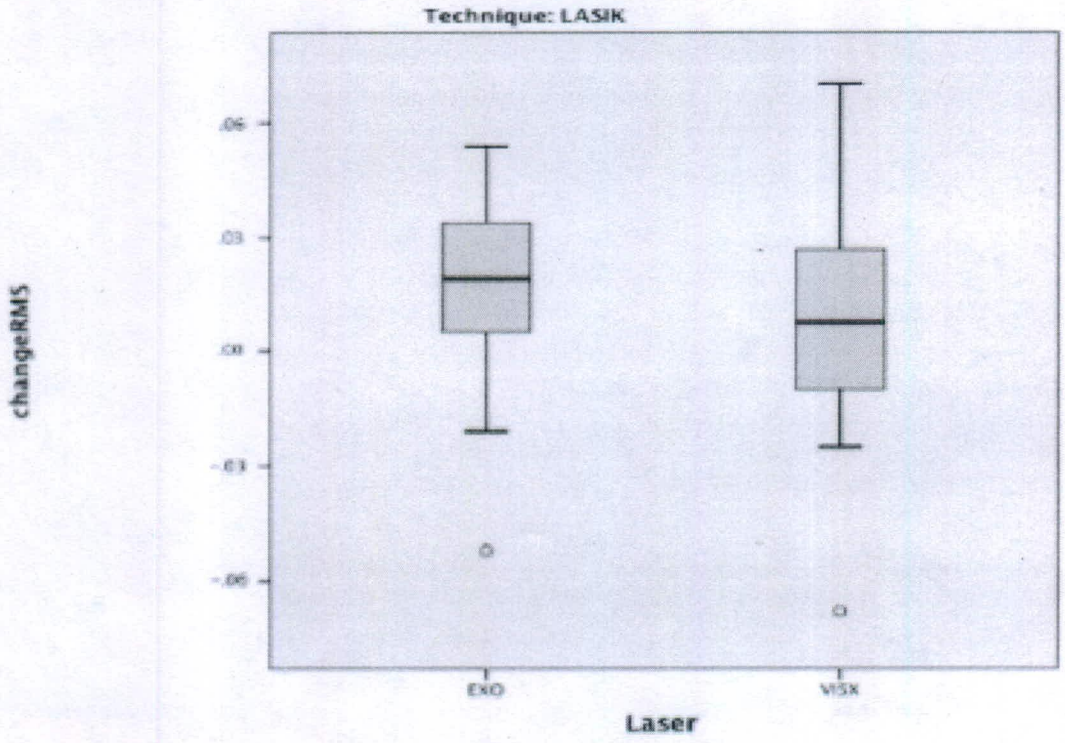

Figure 2: Change in RMS data for PRK between the VISX© and WaveLight© EX500 Lasers. p-value is 0.295

Discussion

- No statistically significant difference
  - Adjusting for preoperative refractive error
- Observations:
  - LASIK higher pre-operative MSE in EX500
  - VISX laser lower induced RMS values
  - 2-4x higher in each category for EX500
    - Moshirfar et al.
- Power

Limitations

- Design
- Sample size
- Generalizability
- Clinical significance

Recommendations

- Further investigation of visual outcomes
- Additional factors
  - Cost
  - Patient characteristics
  - Surgeon preference

References

1. Moren-Barrisuo E, LLoves JM, Marcos S, Navarro R, Llorente L, Barbero S. Ocular aberrations before and after Myopic Corneal Refractive Surgery: LASIK-Induced Changes Measured with Laser Ray Tracing. *Invest Ophthalmol Vis Sci.* 2001 May;42(6):1396-403.
2. Oshika T, Klyce S, Applegate RA, Howland HC, Alaa el Danasoury, M. Comparison of corneal wavefront aberrations after photorefractive keratectomy and laser in situ keratomileusis. *Am J Ophthalmol.* 1999 Jan;127(1):1-7.
3. Thibos LN, Applegate RA, Schwiegerling JT, Webb RH. Members VST Standards for reporting the optical aberrations of eyes. *Vision Science and its Applications TOPS Volume.* 2000;35.
4. Moshirfar M, Betts BS, Churgin DS, Hsu M, Neuffer M, Sikder S, Church D, Mifflin MD. Prospective, randomized, fellow eye comparison of WaveLight Allegretto Wave Eye-Q versus VISX®CustomVue TM STAR S4 IRTM in photorefractive keratectomy: analysis of visual outcomes and higher-order aberrations. *Clin Ophthalmol.* 2011;5:1185- 93.
5. Moshirfar M, Betts BS, Churgin DS, Hsu M, Neuffer M, Sikder S, Church D, Mifflin MD. A prospective, randomized, fellow eye comparison of WaveLight Allegretto Wave Eye-Q versus VISX®CustomVue TM STAR S4 IRTM in laser in situ keratomileusis (LASIK): analysis of visual outcomes and higher-order aberrations. *Clin Ophthalmol.* 2011;5:1339-47.

Retrospective analysis of the post-operative changes in higher order aberrations: A comparison of the WaveLight® EX500 to the VISX® S4 laser in refractive surgery

Donovan Reed MD, Doug Apsey OD, Walter Steigleman MD, Matthew Caldwell MD, J. Richard Townley MD

Wilford Hall Ambulatory Surgical Center (WHASC)

Introduction

Both photorefractive keratectomy (PRK) and laser in situ keratomileusis (LASIK) effectively reduce spherical and cylindrical defocus, the key lower order optical aberrations contributing to decreased visual acuity. Aberrations of the cornea are insufficient to characterize the entire visual quality of an eye. Measurement of the entirety of ocular aberrations is the most definitive means to establish the true effect of refractive surgery on image quality and visual performance.[1]

Both PRK and LASIK have been demonstrated to increase wavefront aberrations of the cornea and alter the comparative contributions of coma- and spherical-like higher order aberrations often inherent to the natural eye.[2] Previous studies have utilized the root- mean-square (RMS) wavefront error as a metric of global image quality, thus effectively isolating different aberration orders contributing to post-operative vision.[3] Moshirfar et al. demonstrated both the VISX® CustomVue and WaveLight® Allegretto systems perform equally in terms of visual acuity, safety, and predictability in both PRK and LASIK refractive surgery procedures.[4,5] Both platforms induced a comparable degree of higher-order and spherical aberrations during photorefractive keratectomy, though no statistically significant difference in terms of the RMS of higher-order optical aberrations was demonstrated.[4]

As future advancements in refractive surgery are being directed toward customized ablations to correct not only lower-order aberrations, but also higher-order aberrations specific to the individual eye, it is important to investigate the utility of the current excimer lasers employed by the DoD in terms of induced aberrations to maximize refractive treatment. The impact on post-operative higher order aberrations between the currently available DoD laser platforms was investigated to offer insight as to which provides the best overall image quality following refractive surgery in the active duty and DoD beneficiary population.

Methods

A retrospective analysis was performed to evaluate the pre and post-operative changes in higher order aberrations following refractive surgery with the WaveLight® EX500 Excimer Laser System (Alcon, Fort Worth, TX) and the VISX® Star S4 IR Excimer Laser System (Abbott Medical Optics, Santa Ana, CA) by evaluating the RMS value of the higher order corneal aberrations post-operatively.

Inclusion Criteria:
Active duty military or DoD beneficiaries who had refractive surgery at the Joint Warfighter Refractive Surgery Center and;
-were 21 years of age or older
-had PRK or LASIK refractive surgery
-completed a 3 month follow-up visit

Exclusion Criteria:
-Subjects who do not meet the inclusion criteria listed
-Subjects who previously had refractive surgery
-Patients who did not have follow-up data
-Pregnant women, or incompetent adults

Patient demographics were matched to avoid bias. Utilizing SPSS statistics software, the mean change in RMS values between the two lasers and refractive surgery procedures were determined. A student's t-test was performed to compare the root mean square of the higher order aberrations of the subjects' corneas from the lasers being studied. A regression analysis was performed to adjust for preoperative SE, as larger refractive errors often require larger ablations, which could ultimately affect the amount of higher order aberrations post-operatively.

Results

	PRK	LASIK
VISX		
Age at Surgery	25.6	31.5
Gender	54M 3M	16M 6F
PreOp SE	-3.53	-3.71
Total eyes	100	32
EX500		
Age at Surgery	28.1	30.2
Gender	50M 40F	15M 8F
PreOp SE	-3.30	-4.38
Total eyes	66	33

Table 1: Patient demographics

	Mean Δ RMS	SD	P-value (T-test)
PRK			0.431
VISX®	0.00122	0.02185	
EX500	0.00425	0.02918	
LASIK			0.295
VISX®	0.00641	0.03011	
EX500	0.0174	0.03417	

Table 2: Change in RMS statistics

	PRK		LASIK	
	B	P	B	P
Preop SE	-0.001	0.551	-0.003	0.161
Laser (EX500 v. VISX)	0.003	0.431	0.004	0.495

Table 3: Regression analysis concerning pre-operative refractive error for both LASIK and PRK

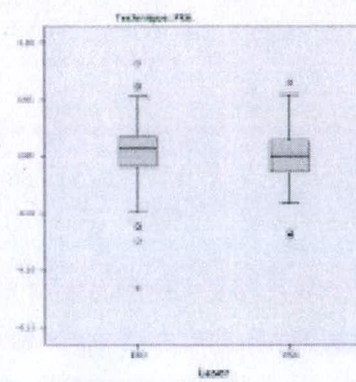

Figure 1: Change in RMS data for PRK between the VISX® and WaveLight® EX500 lasers. P- value is 0.431.

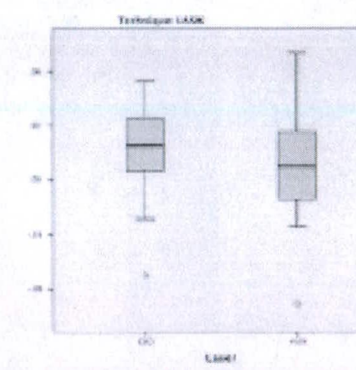

Figure 2: Change in RMS data for LASIK between the VISX® and WaveLight® EX500 lasers. P-value is 0.295.

Discussion

The results suggest no statistically significant difference concerning induced higher order aberrations between the two laser platforms for either LASIK or PRK. After adjusting for preoperative refractive error there was still no statistically significant difference. This is despite the fact patients who received LASIK did have a significantly higher pre-operative SE in the EX500 group. It is likely the statistical significance of this study was hindered by the power, given the relatively small sample size. For instance, every value calculated demonstrated the VISX laser to have lower induced RMS values. Additionally, the induced higher order aberrations by the EX500 were two to four times higher in each category. These findings coincide with the study performed by Moshirfar et al.[4,5] Additional limitations of the study include its design and the generalizability of the study, as the Department of Defense population may be significantly different from the typical refractive surgery population in terms of overall health and preoperative refractive error.

The level at which induced higher order aberrations reach clinical significance is debatable and it is difficult to quantify subjective reports of visual disturbances. Therefore, it remains a challenge to determine whether statistically significant differences in higher order aberrations have a clinically significant impact on visual outcomes. Further investigation of visual outcomes between the two laser platforms should be investigated before determining superiority in terms of visual image and quality post-operatively. Additional factors such as cost, availability, patient characteristics, and surgeon preference should be taken into consideration determining the most appropriate laser to utilize for refractive surgery.

References

1 [illegible] Ocular aberrations before and after [illegible] Corneal Refractive Surgery: LASIK-Induced Changes Measured with Laser Ray Tracing. Invest Ophthalmol Vis Sci. [illegible]
2 [illegible] Comparison of corneal wavefront aberrations after photorefractive keratectomy and laser in situ keratomileusis. Am J Ophthalmol. 1999 [illegible]
3 Thibos LN, Applegate RA, [illegible] Standards for reporting the optical aberrations of eyes. Vision Science and its Applications, [illegible]
4 Moshirfar M, [illegible] Prospective, randomized, fellow eye comparison of WaveLight Allegretto Wave Eye-Q versus VISX® CustomVue STAR S4 IR in photorefractive keratectomy: analysis of visual outcomes and higher-order aberrations. Clin Ophthalmol. 2011 [illegible]
5 Moshirfar M, [illegible] A prospective, randomized, fellow eye comparison of WaveLight Allegretto Wave Eye-Q versus VISX® CustomVue STAR S4 IR in laser in situ keratomileusis (LASIK): analysis of visual outcomes and higher-order aberrations. Clin Ophthalmol. 2011 [illegible]